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An innovative integrated frame to deliver knowledge to policy-makers on inclusiveness and sustainability of agricultural value chains

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Abstract

Sustainability and inclusiveness are on the top of the international political agendas, and policy makers are asked to report progress against such priorities. This is particularly the case for the support to agriculture, where the attention to the increase of agricultural production has now been coupled with a stronger focus on social and environmental aspects.

Such a shift brought to reflect on the relevance of the standard methodologies on value chain analysis. The needs are not only to measure economic, but also to provide social and environmental information in order to shed light on inclusiveness and sustainability. This is the basis on which the Value Chain Analysis for Development (VCA4D) project (2016-2022) was established. VCA4D is a partnership between the European Commission and Agrinatura, the alliance of European universities working together for agricultural research and education for development.

This initiative intends to provide evidence-based knowledge on development impacts of the value chains operations so as to help decision for investment projects in agriculture and to facilitate sectorial policy dialogue.

The objective of this paper is to demonstrate how VCA4D provides an innovative integrated frame to deliver knowledge to policy makers on sustainability and inclusiveness by (i) structuring a scientific methodological framework starting from the perspective of policy makers and based on existing methods or new and more appropriate home-made tools and by (ii) integrating the economic, environmental and social aspects into a comprehensive yet manageable set of indicators. Finally, the paper presents some original results on the application of the VCA4D methodology on three value chains and points at the limits of the approach.

Key words: Value chain, Research, Policy, Sustainability, Inclusiveness

1. Introduction: conceptual background used in the VCA4D

Value chain as “filière” and value chain analysis

Past development operations in agriculture have mainly focused on increasing agricultural production, whilst often ignoring the market and livelihood drivers involved. However, production activities are part of a wider network of interdependent businesses and it is therefore essential to examine them within the VC as a whole.

The concept of value chain (VC) was first introduced on the growing industrial sector in the 1930s to refer to a set of activities linking upstream and downstream agents in a process of production-transformation-distribution of goods and services. This concept has evolved without leading to a unified acception nor a unique and recognized method of analysis (Rastoin and Gherzi, 2010). There is a variety of methods to analyse VCs with specific objectives for different uses. Some are explicitly based on theoretical references, others bring up to pragmatic or operational purposes.

These approaches analyse in different ways the interdependences which are at the heart of the VC, some pointing out the functional links in terms of input/output and management of flows, others highlighting the nature of coordination between actors (Lançon et al., 2016). Three main research streams may be identified in the VC literature (Van der Berg et al., 2006): (i) the “filière” approach, (ii) the conceptual framework elaborated by Porter (1985) and (iii) the global approach proposed by Kaplinsky (1999), Gereffi (1994; 1999; 2003) and Gereffi, and Korzeniewicz (1994).

The purpose of VCA4D is not to discuss the theoretical, analytical or contextual references and frames of those approaches¹. It is to provide knowledge in a pragmatic and operational way to inform decisions of policy makers and all stakeholders involved. The use of the VC concept in VCA4D is closer to the one of ‘supply chain’ or to the French concept of « filière ».

The « filière » (filière meaning thread) approach encompasses various school of thoughts and research traditions. Initially, it was used to analyze the agricultural system of developing countries under the French colonial system. The analysis mainly served as a tool to study the ways in which the agricultural production systems (especially rubber, cotton, coffee and cocoa) were organized. The « filière » framework paid special attention on how the local production systems were linked to the processing industry, trade, export and final consumption.

The concept of « filière » stemmed from an empirical perspective, close to the supply or commodity chains. It was used to map the flow of commodities and to identify agents and activities. Its rationale borrowed extensively from engineering issues highlighting physical and quantitative technical relationships, summarising them into flowcharts of commodities.

Importance has been given to VCs as “devices” for economic development (Raikes et al., 2000; Rich, 2004; Dorward et al., 2006; Temple et al., 2009; Dabat et al., 2010). Analyzing VCs allows shedding light on how their various activities (at different stages of the chain) give rise to aggregated collective impacts (although actors have their own individual objectives). Therefore, policy makers consider them as strategic elements for their policies.

In accordance with this approach, VCs are considered by VCA4D as a sequence of production processes from the initial primary production to its end use and a system of actors orientated towards the market. They are a major channel for agricultural development due to their capacity to create economic value and employment. VCs are an operational framework for fostering agricultural-based activities engaging farmers and businesses through investment and policies.

Value chains and sustainability

In the past, the VC approaches were often used to analyze the dynamics of intensification and agricultural specialisation, without considering environmental and social effects. Sustainability of the

¹ These standards can differentiate the value chain, the supply chain, the global commodity chain or the global value chain (see in this regard Raikes and Ponte, 2000).

production processes was not addressed. Bolwig and al. (2010) stressed that VC analyses have been limited to reviewing the opportunities of income without considering the risks for the poor populations and the threats on the natural capital.

Public and private development interventions in agriculture in developing countries have paid little attention to the related environmental and social outcomes, looking above all at the productive and economic dimensions despite the fact that VC activities are taking place in a wider context that must be considered. The production of agricultural products is essential to provide incomes and jobs but unavoidably consumes natural resources and energy and causes pollution, producing externalities and unsustainability. It also generates positive or, on the contrary, undesirable social effects.

Accordingly, the literature and the available evaluation tools for VC analysis in developing countries mainly focused on economic and market aspects (Fabre, 1994; Kaplinsky and Morris, 2001; Van den Berg et al., 2006). A few authors integrated social aspects as poverty reduction (Lundy et al., 2004) or impacts on smallholders (Bourgeois and Herrera, 2001; Bienabe et al., 2004) or community and gender issues (Ferris et al., 2006) or environmental aspects (mainly energy use).

Environmental and social consequences of VCs activities are to be assessed in order to mitigate their impacts on natural resources and ecosystems and improve their social effects. It is therefore argued that, to support sustainable agri-based VCs, decision makers need to thoroughly consider social, economic and environmental dimensions. By crossing VC analysis methods with sustainability analytical tools and setting out the many effects of the VCs operations, the likelihood of unintended consequences is reduced.

The VCA4D toolkit proposes to analyze the performance of agricultural VCs in developing countries, according to a multidisciplinary methodology, that looks at all the three pillars of sustainability.

Value chains and inclusiveness

Inclusiveness of VCs is generally understood as the ability of a VC to mobilize “the poorest actors” and provide them with economic, social and environmental benefits. According to a review of literature in Shepherd (2016), SNV and WBCSD (2010) define an inclusive business as a socially responsible entrepreneurial initiative, which integrates low-income communities in its VC for the mutual benefit of both the company and the community. This involves the expectation that large buyers will relate with farmers in an equitable manner (GIZ, 2012).

Haggblade et al. (2012) see actions to promote inclusiveness as a response to changes to production and marketing systems that have opened up opportunities for some rural suppliers to access new markets but have exposed others to new threats as a result of quantity and quality requirements of the markets. They argue that agribusiness investments are not inherently pro-poor and that the move towards stressing ‘inclusiveness’ responds to this, by promoting interventions that benefit the poor. Desired outcomes of such an approach include higher income for the poor as well as greater participation of women and youth in VCs (Vermeulen and al., 2008). This approach raises the question of whether VCs more inclusive for poor farmers would hamper competitiveness. Harper et al. (2015) show that it is possible and profitable for businesses to build and maintain such VCs, without subsidies or other non-commercial assistance. They consider ‘inclusive’ VCs to be those that include and substantially benefit large numbers of poor people.

However, although “inclusiveness” tends to emphasise the position of farmers within a chain, the strength of the VC analytical approach is that it moves development efforts away from being farmer-centred to considering the entire chain from producer to consumer (Shepherd, 2016).

VC analysis within the VCA4D methodological frame is intended to help the EC to support actions which benefit the poor (small farmers, women, youth, etc.) by taking advantage of the opportunities offered by local and global markets to create decent jobs and incomes making sure they are associated with social benefits and reduced environmental damages.

2. VCA4D a new tool to inform decision-makers

New goals in the international political agenda

In the past, decision-makers looked above all at the productive and economic dimensions of agricultural growth in developing countries.

Today, beyond the need to increase agricultural production, decision makers have concerns on the creation and distribution of income and jobs, the consumption of natural resources, energy, and pollution and all other externalities.

In the last years, the international community has advanced an ambitious framework to achieve sustainable development and eradicate poverty by 2030 (the 2030 Agenda – ‘Transforming our World’, the Addis Ababa Action Agenda, the Sendai framework on disaster risk reduction and the Paris agreement on Climate Change) thus scaling up and accelerating the global momentum and political will to achieve Food and Nutrition Security (FNS).

The new European Consensus on Development ‘Our World, Our Dignity, Our Future’ constitutes the common response framework of the EU and its Member States to the 2030 Agenda in respect to development policy. It structures EU development cooperation around five pillars/components: People, Planet, Prosperity, Peace and Partnership. With “ending hunger” as the second goal under the 2030 Agenda and sustainable rural development substantially contributing to several other Sustainable Development Goals (SDG), addressing food and nutrition security and sustainable agriculture are considered as fundamental building blocks of the Consensus.

Moreover, the EU Communication on the role of the private sector in achieving inclusive and Sustainable Growth in particular through the promotion of inclusive value chains, places the private sector at the forefront of international development and acknowledges its role as a key partner in achieving sustainable development, in particular in least developed countries and where the agricultural sector (including fisheries and aquaculture) plays an important role as a driver of growth and jobs.

Capacity to produce independent evidence-based information knowledge on value chains is therefore pivotal to draw lessons for action, innovation and accountability, and to ensure sustainable benefits for the poor and most vulnerable.

The Value Chain Analysis for Development project (VCA4D)

In its 2014-2020 cycle, the European Commission (EC) aimed at food security and inclusive development as the main focal sector of intervention, emphasizing particularly the role of agriculture, private sector intervention and investment. The EC Directorate General for International Cooperation and Development (DEVCO) therefore created an analytical tool, VCA4D, to help guide investment decisions and sectorial policy dialogue with partner countries governments on value chains development.

The Value Chain Analysis for Development (VCA4D) project (2016-2022) was thus created to provide independent information to policy-makers and decision-makers all along the chain². This initiative intends to provide evidence-based knowledge on development impacts of the value chains (VCs) operations.

A knowledge assessment established that data and information on VCs were crucially lacking “to understand what is happening”. VCA4D intends to provide quantitative (primary or secondary) data to increase understanding and measuring of the VC impacts. This knowledge is to be considered as a public good, therefore available for all stakeholders of the value chain. The VCA4D methodological framework is organized around four framing questions, that summarise the main concerns of policy makers: What is the contribution of the VC to economic growth? Is this economic growth inclusive? Is the VC socially sustainable? Is the VC environmentally sustainable?

² VCA4D has been established as a partnership between the EC and Agrinatura, the alliance of European universities and research centres working together for agricultural research and education for development.

To provide elements of reply, the VCA4D toolkit analyzes the performance of agro-based VCs in developing countries, according to a multidisciplinary methodology grounded on the three pillars of sustainability. The sustainable development combines economic, social and environmental pillars (United Nations, 1991) that the United Nations Organisation detailed in 17 Sustainable Development Goals in 2015 (UNGA, 2015). VCA4D selected a manageable set of criteria useable by decision makers and in line with policymakers concerns and strategies.

Thus this project stems from a two-fold diagnosis: (i) monodisciplinary analyses approaches are increasingly showing their limits; (ii) liberalization by promoting state disengagement has impoverished public information systems on agriculture in developing countries.

3. A multidisciplinary toolkit combining existing and new methods

VCA4D proposes an innovative analytical framework for value chains that integrates the economic, social and environmental dimensions for a sustainable and inclusive development. The approach is based upon several methodological and conceptual frameworks to shed light on different dimensions of a value chain.

- (i) The economic analysis is based on two well-established frameworks: the analysis of the effects of income creation and distribution as well as the spillover effects of the VC into the rest of the national economy (Prou et Chervel, 1970; Chervel et le Gall, 1978 ; Chervel, 1992 ; Bridier et Michailof, 1995, Chervel et al, 1997 ; le Gall, 2018); supplemented by the analysis of the economic value measured with international prices to determine the VC's ability to compete and create value in the international market (Balassa 1989, Allaya, 1990; Monke et Pearson, 1989). The innovation of VCA4D consists in combining the use of these frameworks, in order to provide policy makers with comprehensive information (European Commission, 1997; Garrabé, 2012) on the inclusive dimension of the VC operations and the balance of the overall gain or loss for the national economy.
- (ii) The tool chosen for the evaluation of the environmental sustainability of a value chain is the Life-Cycle Assessment (LCA). Over the last few decades the method has been normalised (ISO 14040 et ISO 14044) and allows to identify the use/destruction of resources and the emission of substances (that can create pollution and climatic problems) at the different stages of the VC (ILCD, 2012; IPCC, 2006; Nemecek et al., 2014, Basset-Mens et al., 2015). The method allows to evaluate the relative impact of the various stages of the VC or sub-chains, on the depletion of natural resources, the quality of ecosystems and of human health.
- (iii) The social dimension is approached by a specific analysis grid (Social Profile), that takes into account a diversity of strategic objectives and domains that decision-makers have to consider in international cooperation programmes: working conditions, land and water rights, gender, food and nutrition security, social capital and living conditions (see § 4. D). The compilation of the Social Profile allows to draw a social picture of the VC, showing the social impacts directly related to the activities of the CV and those stemming from the more general context (European Commission, 2018).

4. The VCA4D methodological framework

This section is sourced from a communication made by the authors of the present paper that was presented at the 166th EAAE Seminar *Sustainability in the Agri-Food Sector*, August 30-31, 2018, National University of Ireland, Galway, Ireland : Dabat MH., Orlandoni O., Fabre P., Bridging research and policy: evidence based indicators on agricultural value chains to inform decision-makers on inclusiveness and sustainability.

The methodological framework of VCA4D is structured around the need for policy makers to understand, monitor and demonstrate the impacts and results of their policy interventions on VCs in terms of sustainability and inclusiveness. This tool is all the most relevant for the current international cooperation and development paradigm that seeks for an increased involvement of the private sector in investments, wherever in line with the policy objectives of sustainable development (e.g. European Commission, 2014). This framework, by being elaborated jointly by researchers and policy makers, and by being implemented by scientists within the time-schedules of policy makers, enables to track and measure how development actions contribute to sustainable development goals and, in particular to the European Union's cooperation objectives. This also allows for research to be better oriented towards development issues and scientists to understand better the types of information decision-makers can use.

To respond to the concerns on sustainability and inclusiveness, the analytical work is framed around four framing questions that provide policy makers with easy-to-catch elements of information:

- What is the contribution of the VC to economic growth?
- Is this economic growth inclusive?
- Is the VC socially sustainable?
- Is the VC environmentally sustainable?

The answer to the framing questions is provided through a four-step analytical process (functional, economic, social and environmental analysis), using evidenced-based indicators by domain, either measured quantitatively or based on explicit expert assessment and scoring. It mobilizes four scientists (experts in economics, environmental issues, social matters and a national expert of the VC) in using existing information, providing primary data (through surveys and usual data gathering tools) and processing the data.

The functional analysis is their common starting point and place where disciplinary approaches meet. It gives an overall understanding of how the VC is organized and how it operates in terms of governance and technical features. In particular, it collates information on products, actors, flows, technical aspects, governance, policies, dynamic of the markets, etc. It also allows the discussion between disciplinary experts to identify the typologies of actors and systems serving as a common basis to be used throughout the disciplinary analyses.

A) What is the contribution of the value chain to economic growth?

The reply to this framing question stems mainly from the economic analysis. The economic analysis encompasses three areas of work, detailed in a number of core questions and indicators that guide the economists in their analytical process (see Table 1):

1. Looking at the financial viability and profitability for every type of actors along the VC.
2. Assessing the overall effect of the VC in the national economy.
3. Analysing the sustainability and viability of the VC within the international economy.

Table 1: Core questions and indicators relative to the Framing question: What is the contribution of the VC to economic growth?

Core questions	Main Indicators and Themes
Are the VC activities profitable for the entities involved?	Net Income by type of actors; Return on turnover; Comparing farmers' net income with minimum wage, livelihood needs and/or wage opportunities
What is the contribution of the VC to the GDP?	Total Value Added (direct and indirect through backwards linkages); Value Added share of the GDP; Rate of Integration into the Economy (total VA/consolidated VC production)
What is the contribution of the VC to the agricultural sector GDP?	Value Added share of the Agriculture sector GDP
What is the contribution of the VC to the public finances?	Public Funds Balance

What is the contribution of the VC to the balance of trade?	VC Balance of Trade; Total Imports/VC production
Is the VC viable in the international economy?	Nominal Protection Coefficient (NPC); Domestic Resource Cost Ratio (DRC) ³

B) Is this economic growth inclusive?

To reply to this question, both the economist and the social expert focus here on i) how the value added is distributed as income to different population groups, businesses and institutions, ii) on indicators on jobs and iii) on insights on the VC governance and how it involves marginalized groups (see Table 2).

Table 2: Core questions and indicators relative to the Framing question: Is the economic growth inclusive?

Core questions	Main Indicators and Themes
How is income distributed across actors of the VC?	Total Farm Income; Share (%) of final price at farm gate; Total Wages
What is the impact of the governance systems on income distribution?	Income distribution
How is employment distributed across the VC?	Number of jobs and self-employment at different stages (different types)

C) Is the value chain socially sustainable?

Six domains that are recurrent in the policy debates and strategies are considered: Working conditions, Land and Water Rights, Gender equality, Food and nutrition security, Social capital, Living conditions (see Table 3).

The purpose of this analysis is to inform on the opportunities and constraints, the effects or the risks linked to the VC from a social point of view. This is done qualitatively, with an expert-based scoring system (called 'Social Profile') that helps the social expert through a list of over sixty questions tackling the main concerns of policymakers. It must be noticed that it is often rather difficult to separate a specific impact of the VC from the general country context; some direct causal effects may sometimes be identified (e.g. food security through incomes distributed during the lean season) but this analysis often points at the general conditions that apply on a territorial level to all VCs.

Due to the vast scope of the social analysis, this is also expected to warn on little known elements and risks that should be examined more carefully.

Table 3: Core questions and indicators relative to the Framing question: Is the VC socially sustainable?

Core questions	Main Indicators and Themes
Are working conditions throughout the VC socially acceptable and sustainable?	Respect of international norms; Respect of contracts; Risk of discrimination and forced labour; Job Safety; Attractiveness; Child labour and education...
Are land and water rights socially acceptable and sustainable?	Adherence to and application of VGGT; Equity and security of access to land/water resources; Transparency of procedures; Consultation; Arbitration procedures; Compensation procedures...
Is gender equality throughout the VC acknowledged, accepted and enhanced?	Inclusion/exclusion of women in certain activities; Access to resources, goods and services (land, credit, extension services, inputs...); Participation in decision making (on

³ It is interesting to notice that the Domestic Cost Ratio is computed in a simple way using international prices for tradeable goods and eliminating domestic transfers, therefore avoiding complex shadow pricing methods that would not allow for easy understanding and cross-country comparisons.

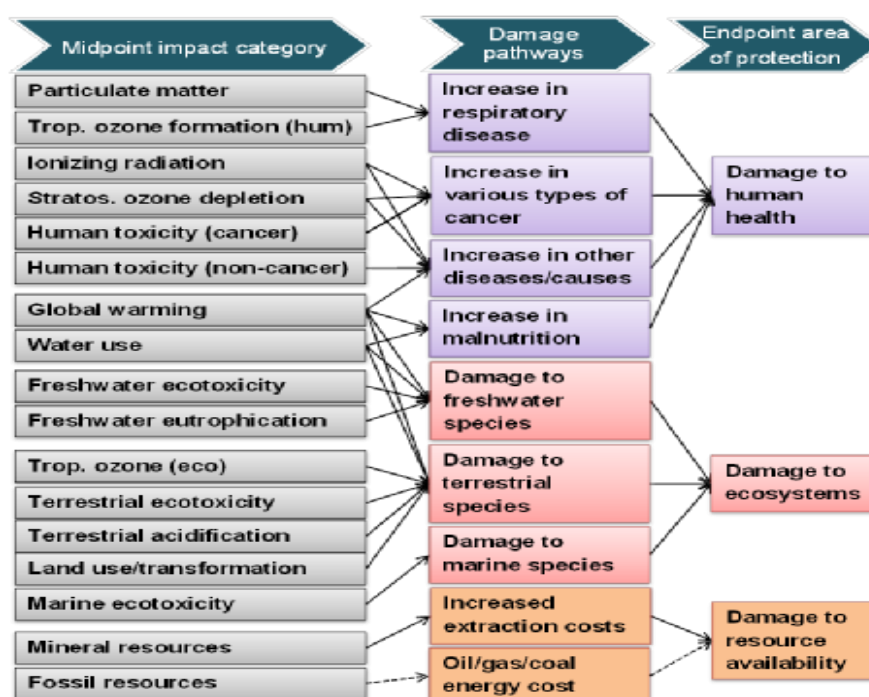
	activities, organisation, income...); Responsibility and empowerment in collective processes; Arduous working conditions...
Are food and nutrition conditions acceptable and secure?	Contribution of the VC to the availability, accessibility and stability of food resources; Food diversification; Nutritional quality; Price instability...
Is social capital enhanced and equitably distributed throughout the VC?	Strength and representativeness of producers' organisations; Information sharing; Level of trust among actors; Participation in decisions and community activities; taking traditional practices into account...
To what extent are major social infrastructures and services acceptable? Do the VC operations contribute to their improvement?	Access to infrastructures and services: health, education, training, housing, water and sanitation; Quality of these infrastructures and services...

D) *Is the value chain environmentally sustainable?*

The environmental sustainability is assessed through the Life Cycle Assessment (LCA) method, as this fits coherently within a VC approach. The inventory and measurement of resources used and substances emitted by the VC operations at the different VC steps is processed by the environmental expert using impact factors on different environmental categories.

The analysis informs on potential damages, risks or benefits for three areas of concern: Resource depletion, Ecosystem quality, and Human health (see Figure 1 and Table 4).

Figure 1: Overview of the LCA structure



Source: <https://www.pre-sustainability.com/recipe>

Table 4: Core questions and indicators relative to the Framing question: Is the VC environmentally sustainable?

Core questions	Main Indicators and Themes
What is the potential impact of the VC on resources depletion?	Resources uses (water, fuel...), absolute and comparing systems

What is the potential impact of the VC on ecosystem quality?	Sizeable emissions of substance (CO ₂ , NH ₃ ...), absolute and comparing systems; Significant Resource use; Potential deterioration of land quality, of biodiversity, etc.
What is the potential impact of the VC on human health?	Sizeable emissions of harmful substance, absolute and comparing systems; Potential deterioration of safety (potable water, working conditions, etc.).

E) Overall analysis

The disciplinary analyses inform on the core questions that shed light on actual nature and dimensions of impact and provide evidence and expert advice to respond to the four framing questions. For each core question, indicators are defined to inform decision-makers. A deliberate choice was made not to aggregate the knowledge elements into one global appraisal or a single indicator. Informing decision makers on each of the four framing questions allows them to make their own judgement. They have to weigh the various elements according to the context and their own strategies. It is intended to help them reflect, not to substitute to their decision. In addition, the team should deliver its experts' views and recommendations, building on these elements with a comprehensive and systemic perspective of the VC. This is facilitated by providing a risk analysis of the VC based on the 4 disciplinary analyses.

5. Highlights on the first results on three Value Chain Analyses

This section briefly presents the main results of three Value Chain Analyses performed using the VCA4D methodology. The examples first give an overview of the function of the VCs (from the functional analysis), then discuss the inclusiveness and the sustainability of the VCs based on the calculations of quantitative indicators and information provided by the studies. Last, some strategic paths for policy dialogue are presented as they arise from main findings and could lead to operations and investments that foster both growth, sustainability and inclusiveness.

Cassava in Ivory Coast (Mendez del Villar et al., 2017)

Overview of the value chain

Cassava is one of the main food crops in Ivory Coast. National production amounts to around 5 million t per year and consumption is second only to yams and ahead of rice. Cassava has grown significantly over the last decade with production rising at an average annual rate of 8.5% between 2005 and 2015. However, the VC may be susceptible to crises, as in 2016 when production declined by 11% due to drought and led to a major shortage of cassava in the markets of Abidjan.

The map of production has evolved rapidly in the last few years. The Southeast region was until recently the main production centre (more than 40% in 2001) but its importance is declining. This is due to land competition with other more profitable plantation crops (cocoa, rubber, palm oil), the prominence of peri-urban agriculture around Abidjan and continued urbanisation that weighs heavily on agricultural land. Cassava production has since shifted towards the central and central-west areas of the country which are becoming the dominant production areas.

In the past, cassava was considered an inter-seasonal crop intended mainly for personal consumption. Today, the growing demand for cassava derived products (attiéké, pressed dough) in urban centres and for export has created greater opportunities for revenue, notably in the processing and marketing activities, especially for women. New actors are beginning to appear in this VC.

Inclusiveness and sustainability

Cassava-related activities are profitable. However, income remains limited for agricultural production activities (between 25,000 and 39,000 CFA per year per farm) and for artisanal processing (between

10,000 and 33,000 CFA per processing unit). Industrial processing is the most profitable, but only represents 5% of processed volumes. The situation for traders is more comfortable due to the expansion of urban markets.

56% of the direct value added is generated in the processed products sub-chain, 37% in the fresh sub-chain and 7% in the export sub-chain. Agricultural producers generate an important part of this value added: 40% on average and up to 47% in artisanal and rural circuits. Activities along the VC generate indirect effects in the national economy (grinding services, manual pressing, guarding, transport, purchases of energy, packaging, etc.). With 597 billion CFA in total value added (direct and indirect), the VC contributes 12.4% to the agricultural GDP and 2.8% to the national GDP.

The contribution to public finances is low because of the manual and artisanal nature of the product. Direct taxes on herbicides, energy, imported material and the market fees do not exceed 13 billion CFA, or 0.2% of the state budget. Cassava presents a weak positive balance of trade of around 4 billion CFA. The share of exports could however increase in the coming years due to the international reputation of processed cassava products (attiéké & placali). The VC, with 9 million workers in 2016, accounted for 4.7% of employment in the country.

Economic growth generated by the cassava VC can be considered inclusive. In fact, of the total direct income distributed in this VC, 28% is net operating income for producers, who are mostly smallholders, and 18% are wages paid for various activities, therefore representing almost half of the total. The value chain overwhelmingly employs women; they represent about 80% of producers, 90% of traders and almost 100% of processors. The involvement of women provides leadership opportunities and financial autonomy. Cassava-related activities are also becoming more attractive to youth on: production, jobs related to manufacturing of traditional processing tools (press, graters ...), local services for farming tasks and processing operations. Deceleration in the departure of rural youth to the city, can also be attributed to the attractiveness of cassava-related activities.

The cassava VC is socially sustainable, yet significant areas for improvement remain. The main positive effect is the contribution of cassava in its various forms to food and nutritional security. Living conditions, in terms of access to infrastructure, housing and drinking water, are gradually improving in areas where cassava-related activities are developing. Nevertheless, these positive impacts are tainted by a great precariousness and insecurity over access to land for the producers, which calls into question the social sustainability of the VC.

Cassava activities do cause some environmental damage. Agricultural production represents less than 10% of total environmental impacts (eutrophication), far from the 40-70% that has been recorded in countries where cassava is produced by intensive systems and use of fertilizers. The main environmental impacts result from the treatment of wastewater and the use of wood. Attiéké can be cooked on the one hand using wood, a renewable energy source that has negative impacts on human health (emissions of fumes and particles) and ecosystems (deforestation, loss of biodiversity), or using butane gas, a non-renewable energy that has significant impacts on resource depletion. The transport of roots by small vehicles (often pick-ups) multiplies the roundtrips and diesel consumption, with consequences for human health (particle emissions, climate change) and non-renewable resources. The bad status of secondary roads increases fuel consumption and environmental impacts. However, the VC has limited effects on the environment and can therefore be considered sustainable. This is due to the extensive nature of agricultural production with a few damaging inputs followed by several years of fallow to maintain soil fertility; and to a weak environmental footprint for the processing into attiéké and other derived products.

Support to policy dialogue: Supporting industrial investment for employment?

New leaders from rural areas are beginning to appear in this value chain, and are improving and structuring both the production and processing (by formal associations, cooperatives, platforms, federations, purchasing organisations...). Cassava also attracts new urban investors (graduates, former officials, entrepreneurs...) who are trying to develop integrated production and processing models (contract farming...) although few have succeeded until now. Foreign industrial groups also wish to invest in Ivory Coast in processing plants of cassava in flour and starch. Industrial units could become increasingly important in the coming years if public and private investment plans materialise. In

particular, they could influence prices paid to producers, and compete with semi-industrial units, already in a rather fragile situation, on secondary urban markets, major national markets, and other African countries. It should be verified whether the recent uptake in cassava cultivation calls into question the inclusiveness of this value chain.

The results of the study should allow the EUD to deepen their policy dialogue with the Government on the extent to which large scale industrial investments could threaten the sustainability of the VC on a number of issues: would the purchases of manioc by investors risk to disrupt the current organisation of the market? Are there risks of land competition with food production crops? Is there a risk of land grabbing for small producers? Is there sufficient local capacity to produce improved seed to supply these industries? How can they be competitive with the starch imported from Asia where yields are double and labour less expensive? What kind of jobs will be created in these companies?

Mango in Burkina Faso (Parrot et al., 2017)

Overview of the value chain

In West Africa, mango is both exported and consumed locally. Burkina Faso represents between 11% and 18% of the production in West Africa. The total volume of production in the country is estimated between 100,000 and 200,000 t. The flows are poorly known except for the exports to Europe that amount to 50,000 t of fresh mangoes: 4,000 t of fresh mango exported by boat and 400 t by plane, 500 t of mango puree, 1,900 t of dried mango mostly via international companies. Exports in continental Africa (towards Ghana, Niger, Algeria, Morocco) are estimated at 8,000 t of fresh mango by truck, but in reality, it is probably more. The national market is difficult to estimate and could absorb between 50,000 and 150,000 t.

The production is subject to the constraints of the international markets in terms of product homogeneity, varietal diversification, and organoleptic qualities. Mango remains a product with a strong export demand, but even if the VC is competitive within the international economy, it is not clear whether actors will succeed in adapting to the increasingly stringent sanitary controls, that entail increasing costs of adaptation.

Several political and national strategies aim to improve the business climate and support the public private sectoral dialogue for agricultural development. The VC benefits from significant support from the World Bank since 2007 through the project PAFASP.

Inclusiveness and sustainability

The VC makes a real contribution to economic growth (total VA of 30 billion CFA, 2,9% of the agricultural GDP), with indirect effects on the national economy related to transport services and packaging. The VC creates involves around 28,000 people, providing many jobs opportunities.

The income distribution appears globally fair for producers in the export sub-chains (both to Europe and other African countries) for both dried and fresh mangoes. In the domestic sub-chains, where the prices for the producers are 10 times cheaper, income distribution is more unequal. Globally, the economic growth of the VC is inclusive, but there are challenges such as the low level of trust and circulation of information between actors; and the difficulty to accept women undertaking traditional masculine roles, both in production or in management of processing or packing units.

The social sustainability of the mango VC is moderate. The VC makes a positive contribution to working and living conditions and to food and nutrition security of vulnerable or marginalised populations. It contributes moderately to gender equality and social capital. The situation remains problematic in relation to access to land, given challenges such as: land insecurity and exclusion of migrants, women and youth from land ownership rights necessary to start an orchard; child labour in the domestic sector at the expense of school attendance; low levels of collective organisation of producers in groups and cooperatives as well as their poor access to information.

From an environmental perspective, the production of fresh mango by traditional extensive orchards does not create significant environmental damage. For dried mango, environmental harms depend

mainly by the drying technology used. Moreover, by concentrating the products (22kg fresh mango are needed on average to produce 1kg of dried mango), this sub-chain results in higher levels of damage.

Support to policy dialogue: Anticipating the impact of technical innovation in the value chain

For several years, the EU has been supporting this VC in Burkina Faso, notably by facilitating the compliance with sanitary and phytosanitary standards (SPS) by local companies and strengthening the capacities of the local institutions in managing SPS. However, the study demonstrated that economic operators face several constraints, which require public policy responses. The EUD may also engage a political dialogue on other bottlenecks that hinder the country's agricultural development: transportation difficulties, power and water cuts (which results in equipment breakdowns, deterioration of the quality of fruit processing and packaging, losses), crossborder trade difficulties (slow administration/bureaucratic problems, illicit expenses...), mismanagement of the land in municipalities where processing units are located (proximity to houses, risk of fires...) and in rural villages where the orchards are located.

Moreover, the VC is rapidly changing, facing a strong growth in demand from the various markets. This results in investments for the modernisation of orchards (supported by the World Bank) and drying units. In fact, South African companies developed electric tunnels that would improve the quality of the dried product (uniform drying, fewer losses) while limiting the environmental effects. The diffusion of orchards and new energy efficient drying 'tunnels' are expected to improve productivity in the VC and to reduce the environmental impact, but their effects on small producers and processors will need to be addressed.

Particularly, in relation to the technological innovations for drying mangoes, the EUD could support the formulation of the national strategy by bringing the knowledge provided by the VCA4D study in the policy dialogue with the Government: Will the market be able to absorb higher production of dried mangoes? Will the existing national companies be able to make the necessary investment? What will be the impact of such changes to the contribution on public finances or to employment? Will the improved dried mangoes be able to be sold at higher prices? If such technologies are economically and socially beneficial, can the Government further promote the transition towards their diffusion?

Green beans Kenya (Kleih et al., 2017)

Overview of the value chain

Kenya is the second largest exporter of green beans to Europe. Beans are a popular cash crop for farmers of all sizes. Kenya's success is based on climatic and geographic competitive advantages, market segmentation, investments in certification schemes, value adding through packaging, servicing niche markets and investments in marketing. However, Kenyan Green beans are exported in a highly regulated and pesticide-residue sensitive market. Maintaining high quality standards is critical as exports face the risks of a ban if the current Sanitary and Phytosanitary standards are not met.

Smallholder farms (SHF) of <2 ha along with a few medium sized farms of 2 to 10 ha account for around 60% of green beans produced. SHF are usually engaged in multiple crop production, including green beans. Large farms, over 10 ha, account for around 40% of the production. There are two main types of post-harvest handling operations: packing (to export fresh green beans), and processing (mainly for exporting canned beans). Packhouses work with SHF that devote on average 0.1 ha to green beans whilst SHF that are involved in the canned bean channel are smaller at around 0.02 ha.

The bulk of the production is exported fresh. The quantity of fresh green beans exported was around 34,000 t in 2016 (more than 50% of the production), the main export markets being the United Kingdom, followed by the Netherlands and France. The quantity of canned beans exported was close to 900 t in 2016; the main importing countries being France, followed by Belgium and the United Kingdom.

Inclusiveness and sustainability

Engaging in green beans production generates income and cash flow for smallholder farmers despite the risks of variable demand, and inter-annual price instability and high input costs: for exported fresh beans, large-scale farms and SHF who have links to packhouses and exporters (e.g. contracts to acquire inputs and sell as self-help groups), operate efficiently and can make a profit (respectively €12,784 and € 263 p.a.). Scattered SHF appear struggling to make a significant income on a continuous basis (€ 56 p.a.). Due to the lack of collective organisation, they rely on brokers, agents and middlemen for the sale of their produce, which reduces their farm-gate price. For canned beans, with high yields, the few large farms get high incomes (€ 67,620 p.a.). SHF who produce for the canning industry make a smaller profit (€ 44 p.a.) than in the fresh bean market and this is partly due to their small plot size (i.e. 200 sqm).

The total value added of the green beans value chain substantially amounted to € 68 million in 2016. Green beans provide a minor contribution (about 0.33%) to the agricultural GDP of Kenya. The contribution of the VC to public finances is relatively modest also (€ 3.96 million). Nevertheless, the VC provides a substantial net contribution to the balance of trade: € 62 million, corresponding to 1.5% of the total annual exports. The VC is well integrated into the domestic economy which is reflected by a rate of integration (total value added divided by the total production) of 0.83. It is viable within the global economy (Domestic Resource Cost ratio is 0.36).

The VC contributes to poverty reduction supporting the livelihoods of about 52,000 smallholder farmers and a large number of hired workers (40,000 to 70,000) in farms and factories. It contributes to inclusive growth through the involvement of two groups of beneficiaries: SHF who produce small quantities of good quality beans on small plots of land (accounting for almost 60% of total production) and an informal and casual workforce that supports the labour-intensive system of production and processing. Women in particular benefit from employment opportunities as they carry out most of the tasks associated with production and processing, and make up the majority of the workforce (approximately 80%). As a result, they gain a degree of financial independence from their involvement in the VC.

Engagement with export markets, particularly Europe, has raised companies' awareness of social responsibilities. Kenyan legislation is evolving positively in key areas of labour and land tenure. Returns from small-scale production benefit the local economy and are invested in children's education, health care, housing, small businesses and in the farm. However, exporters express less enthusiasm for engaging with SHF, citing transaction costs and reliability issues. The declining trend in the number of SHF engaged in the VC could impact on social sustainability. From the side of employment, casual and temporary employment is unlikely to provide enough job and income security to provide a living wage.

The majority of the growing workforce are being employed on an informal basis due to the variability of demand, this has implications for the terms of employment plus job and income security.

From an environmental perspective, yield, fertilizer use, water and energy use for irrigation and land use are key drivers of environmental impacts of the beans at farm level. Pesticide applications have little contribution to total impacts. Fresh beans air-freighted transport have large impacts on the environment, the other steps of the VC occurring in Kenya have relatively limited impacts. On the contrary canned beans are cooked, thus most of the impacts happen within the Kenyan boundaries. However, this sub-chain represents an interesting alternative to fresh beans from a global environmental point of view since the cooking is done more efficiently in a factory than with home cooking, and the product is stabilised for several years and does not need to be transported quickly nor refrigerated during transportation.

Support to policy dialogue: How to limit the decline of smallholders and unfair employment?

Matching export market supply and demand has proved difficult for producers and exporters. Compliance with multiple quality, health and safety, environmental and social standards demanded by export markets is costly and technically challenging to SHF and small traders. As a result, such actors are gradually excluded from participation in international trade. There is anecdotal evidence that the number of SHF engaged within the chain has declined significantly over the last 5 years. Reliability of supply from SHF to commercial companies is a key concern. When working with SHF, export companies express the need to improve control over inputs (e.g. pesticides use in this highly regulated export market) and lower costs associated with logistics and management of supply. Unless these issues are tackled, export companies could gradually move towards large-scale commercial production, despite the fact that SHF produce the best quality green beans. From another side, an expansion or creation of new large commercial farms could increase job opportunities, whilst simultaneously bringing issues of land tenure and land acquisition/consolidation to the foreground.

The study provides some food for thought which can help to understand whether the current decrease in number of small producers and a parallel increase of employees by large producers would make this VC more or less inclusive. The policy dialogue could focus around some strategic issues on how to support SHF to become more reliable partners for well-established processing companies (technical extensions, input supply, capacity building, control of input use) and on how to establish outgrowers schemes with SHF and encourage export companies to improve the working conditions of their workforce (improving corporate social responsibility).

6. Limits and first lessons learned

It is to underline that the methodological features of VCA4D also come with limits. The features and limits which appear after two years of implementation of the project are discussed here.

Some features and limits

- 1) VCA4D is built upon a value chain approach. This is a clear limit, but which is relevant for the purpose of fostering investments and policy interventions in agriculture, especially in view of strengthening private sector activities (including farmers' production activities). VCA4D is a valuable tool to appraise the performance of investments against income generation, inclusiveness and sustainability development goals. Nevertheless, other types of analysis, such as those using territorial, spatial and livelihood approaches can complement VCA4D, bringing in new elements for appraising its results and understanding the VC system. Interconnections with such approaches shall be further investigated.
- 2) The VCA4D methodology provides a global picture of sustainability of a value chain at a given moment in time. Although the limited number of measurable indicators can be monitored by policy makers over time, it does not include a full analysis on the dynamics of the VC and of the markets, nor specific projections of the trends and performances. Such analysis can be done in complement of VCA4D. However, updating VCA4D analyses every two or three years, can also provide relevant information on dynamics and trends.

- 3) VCA4D analyses are limited to activities happening within the country. They are not reviewing the global VCs. This raises a set of questions for export products or commodities. This choice was driven by the fact that most of the EU development and cooperation funds are channeled through National Indicative Programs and so are directed towards activities within the borders of the country (where government and local actors can act). The EU funds for value chains development are spent at the national level, which becomes the relevant analytical framework.
- 4) A strong feature of the VCA4D approach is that it must provide evidence-based, reliable scientific information in a time span compatible with the decision-taking processes. VC analyses are based on scientific evidence, but are not research studies that could take much longer time for extensive data collection campaigns. In practice, only orders of magnitude are needed for policy makers to take decisions. For VCA4D timeliness is very important.

Shortcomings and areas for further work

The VCA4D project has been active for almost two years, with more than 10 studies completed and another 15 at different stages of implementation. Enough for initial considerations on difficulties and shortcomings of the methodology.

Application of the Life Cycle Assessment (LCA) method, despite its pertinence and compatibility with a value chain approach, raises two main problems : (i) the difficulty to introduce the results in an understandable way that “speaks” to (non-scientists) decision-makers; (ii) some elements that are critical for policy makers are not sufficiently taken into account or put forward by the LCA. This is particularly the case of the adaptation that climate change imposes on value chains, and of the impacts of value chains on biodiversity.

Another issue is the difficulty to integrate results from the three types of analysis (Economic, Social, Environmental) into common conclusions. Operationally, the team works in a cooperative manner and shares the drafting of the functional analysis, but conclusions of the economic, social and environmental analyses are presented separately, often only placed next to each other, not attempting to make inter-connections between the different dimensions⁴. In the future, interdisciplinary workshops may help to deepen discussions across the different disciplines.

7. Conclusions and perspectives

Since the beginning of the project, the VC analyses were carried out in developing countries in Africa, Asia, Latin America and the Caribbean (see Table 5).

Table 5: Value chain analysis completed or ongoing

	Aquaculture	Banana	Beef	Cashew	Cassava	Cocoa	Coffee	Cotton	Egg	Green beans	Lime	Mango	Palm Oil	Pineapple	Vanilla	
Burkina Faso												X				1
Burundi		X														1
Cameroon						X		X								2
Guinea Bissau											X	X				2
Ivory Coast					X											1
Kenya										X						1

⁴ Beyond sharing the same typology of actors and sub-chains.

Mali				X												1
Sao Tome Principe						X										1
Sierra Leone				X									X			2
Swaziland			X													1
Tanzania							X									1
Togo														X		1
Zambia	X								X							2
Zimbabwe			X													1
Cambodia	X															1
Indonesia													X			1
Papua New Guinea						X									X	2
Dominican Republic		X										X		X		3
Honduras							X									1
	2	2	2	2	1	3	2	1	1	1	1	3	2	2	1	26

In conclusion, VCAs provide a detailed picture and overview of the VC's operations and their impact on the main pillars of sustainable development. Overall, fifty analyses are planned, and updates will be carried out two or three years later in order to analyze the main evolutions.

VCA4D attempts to analyse the agri-based VCs' contribution to growth, inclusiveness and sustainability, linking the operations of all the actors within the national economy and to the social and environmental context. This framework of analysis was built by combining existing standards and methods, and creating new expert tools to respond to the needs of decision-makers.

A limited number of selected economic, social and environmental indicators are defined, measured and reported in a comprehensive way and in a multidisciplinary exercise.

The framing questions reveal the present priorities in the global agenda of development. The methodological framework does not aggregate the knowledge elements into one global appraisal or a single indicator. It is intended to help understand the main impacts of the VCs' operations and how separated domains are interconnected, not to benchmark or rank performance. Informing decision-makers on the framing questions, allows them to make their own judgement, weighting elements to take into account the idiosyncrasies for each context.

An information system, based on the indicators, is being developed and will provide researchers and decision-makers with a wealth of information contributing to fill the general data gap existing on these activities in most developing economies. Taking stock of many VC analyses across the world (different countries, different products, different situations) will allow to learn lessons on how producing systematized information can contribute to the strategic reflection of policy-makers and stakeholders.

Finally, the paper demonstrated that VCA4D provides a pertinent and manageable framework that opens up for further deeper dialogue on issues of international cooperation. By responding to a clear needs assessment of policy makers, VCA4D increases their ownership on the results and the perspectives of them being integrated into policies.

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